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FINAL TECHNICAL REPORT

NASA Research Grant NAG 5-2121

**WHITE-DWARF COMPANIONS
OF DWARF CARBON STARS**

Principal Investigator: Howard E. Bond

Space Telescope Science Institute

(NASA-CR-197873) WHITE-DWARF
COMPANIONS OF DWARF CARBON STARS
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This is the Final Technical Report for NASA grant NAG 5-2121, which was awarded to the Space Telescope Science Institute, Baltimore, MD, during the interval 11/1/92 through 10/31/94. The grant supported research that was carried out with NASA's *International Ultraviolet Explorer (IUE)* satellite. The Principal Investigator was Howard E. Bond. D. J. MacConnell (Computer Sciences Corporation, STScI) was Co-Investigator.

The recently discovered class of dwarf carbon stars are a major challenge to our understanding of stellar evolution and nucleosynthesis, since we do not expect that unevolved dwarf stars can attain the central temperatures necessary to synthesize carbon. The only way these stars can be understood, under conventional stellar evolution, is if they were the close companions of more massive stars, which became red giants and synthesized carbon, and then transferred the carbon to the companion star through a stellar wind or Roche-lobe overflow.

This scenario leads to a prediction that all dwarf carbon stars must have white-dwarf companions (i.e., the remnants of the red giants that manufactured the carbon now seen on the surface of the dwarf).

Thus the scientific goal of the project was to use *IUE* to search for hot white-dwarf companions of dwarf carbon stars, as a test of the above scenario. We received 1 US1 shift on *IUE* for this program. It was devoted to a single-exposure, short-wavelength spectrum of the dwarf carbon star LHS 1075, obtained on 1992 August 23.

Unfortunately, the spectrum failed to show any trace of the expected white dwarf. Although detection of a hot white dwarf would have provided very strong support for the above scenario, the failure to detect one is not fatal to the proposed mechanism. Analysis of the spectrum, and comparison with theoretical models of cooling white dwarfs (carried out by postdoctoral research associate Philip Martell), shows that we can place the following limit: if a white-dwarf companion to LHS 1075 does exist, its temperature is lower than about 11,000 K, and hence its cooling age must be larger than about 10^9 years. Thus the interaction with a former red giant described above could still have occurred, but it must have happened more than a billion years ago.

Further testing of the mass-transfer hypothesis to account for dwarf carbon stars will require ultraviolet observations of more of them, either with *IUE*, or with the *Hubble Space Telescope*. We are now preparing a brief paper discussing our results on LHS 1075.

EQUIPMENT AND PROPERTY INVENTORY REPORT

Principal Investigator: Dr. Howard Bond

Grant : NAG5-2121

Equipment/Property Purchased: None

PATENT/INVENTION REPORT

Principal Investigator: Dr. Howard Bond

Grant : NAG5-2121

Patents/Inventions Developed: NONE